Computer Impacts on Saudi Arabian Public Bureaucracy*

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Abstract

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This paper reports the findings of exploratory research on the impact of computers on management and organization in the public sector of a developing country using a sample of 42 work sub-units. Results show that computerization improved information received by management, who used this information in accordance with needs reflecting sub-unit work technology. Hypothesized effects on the number of positions and job content were not supported, but an association was found between computerization and a downward shift in the locus of decision-making. Results were interpreted to suggest the possible moderating effect of computer usage and societal culture.

Introduction

In organizations all over the world, computers are becoming one of management's principal assets. Recent advances in computer technology, and the increasing appreciation of its benefits, have convinced many private and public organizations in developing countries of the need to spend large sums of money on obtaining and operating computers. While, in some cases, these are acquired solely for their prestige value, managers are often genuinely interested in realizing the potential benefits of computers in terms of information processing and cost saving. In industrialized developed countries, the impact of computers on management and organization has been the subject of speculation and research since the early usage in business firms. The purpose of this study is to extend the investigation of computer impact to the public sector of a developing country in the Middle East, namely Saudi Arabia.

Previous Research

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Interest among practitioners and academics in the impact of computers was at its highest point in the 1960s. While interest has declined since then, none of the questions behind it has been thoroughly researched. The relatively little research undertaken on the subject has yielded conflicting findings, underlying the lack of a theoretical framework linking computer usage with management practices and organization structure variables. A review of the relevant literature reveals a certain path along which research in this area has progressed.

Computer imperatives

In earlier cenceptions, the computer was presented as a prepotent technological factor which was certain to shape organizations and profoundly influence management. Findings of some earlier studies (Whisler 1965, 1970; Mann and Williams 1962; Withington 1969) were interpreted to support the prediction that computerization has certain effects on organizational structure such as recentralization, reduction of middle management and clerical positions, and the flattening of hierarchy. However, as Table 1 shows, other research results did not confirm this; it was found, in some cases, that computer usage favoured decentralization rather than centralization, and upgraded rather than downgraded middle management positions. To reconcile these conflicting results, an alternative explanation was suggested by Hunt and Newell (1971) which regards the computer as a management tool that can be used in a variety of ways to serve management ends and, hence, it does not by itself impose adaptations on organizations. It is interesting to note that initial research on the technology-structure relationship (Woodward 1958, 1965; Zwerman 1970) also suggested that work technology determines characteristics of organizational structure. This viewpoint was later abandoned in favour of a new paradigm emphasizing management's role in perceiving technological and situational factors, interpreting their implications for the organization and developing strategies to deal with them.

Computer Contingency

Since the early 1970s, research on computer impact has exhibited a higher degree of sophistication. Recent studies (Klatzy 1970; Hunt and Newell 1971; Robey 1977; Carter 1984) suggest that computer effects may be mediated by a number of factors. According to Klatzky (1970), the computer impact becomes more manifest and prominent as use of the computer extends across organizational functions. Carter (1984) predicted similar results as familiarity with the computer and computer proficiency among organization members increased. Hunt and Newell (1971) suggested that computer effects vary depending on the work technology of the organization. Robey (1977) reviewed and analyzed previous research findings and found support for the moderating effect of the organizational task environment. Meyer (1968) and Blau, Falbe, McKinley and Tracy (1976) included the computer in their conceptions of work technology. The automation of functions through the computer was one of two technology variables in Blau et al.'s (1976) model of work technology — the other being the production technology. However, although these more recent research efforts have advanced our knowledge of the computer impact, confusion still persists regarding its nature and impact. The need for further research is evident, but first the empirical findings of previous research must be integrated to see in what direction they lead.

Level of Analysis

Fry (1982) identified three organizational levels at which technological impacts have been studied: the whole organization, the work group or sub-unit and the individual. Recent studies (Lynch 1974; Van de Ven, Delbecq and Koeing 1976; Fry 1982; Fry and Slocum 1984) favour investigating the technology–structure relationship at the sub-unit level, because an organization may have more than one technology. Even within a single sub-unit, the work technology may be multifarious; thus McDonough and Leifer (1983) used the computer sub-unit as an example of work sub-units having both routine and non-routine tasks.

An implicit assumption of the earlier studies was that computer usage has pervasive influences throughout the organization, but this assumption is no longer tenable. In one of his more recent papers on the subject, Whisler (1967) conceded that the strongest and most immediate effect will be felt in departments such as production, accounting, purchasing and distribution, while effects on general management elsewhere will be partial and indirect. Results obtained by Withington (1969) and Stewart (1971) confirm that the effects of the automation of routine functions do not spill over to other areas or levels across the organization. In other words, if the personnel or accounting department is using the computer, there is no reason to expect other units to be significantly affected by it. More recently, although Carter (1984) argued in favour of viewing the computer as the predominant organization technology, her research results did not entirely confirm this. The computer was found to have a significant impact only on some tasks and administrative levels with size acting as a moderator. It is therefore clear that research is most appropriately conducted at the work group or sub-unit level, a principle that guides the empirical focus of the study reported here.

Sampling and Methodology

Interest in the subject originated in speculative papers (e.g. Leavitt and Whisler 1958), which were followed by case studies and small sample research with very few studies attempting a field survey design or hypothesis testing using inferential statistics. As shown in Table 1, sixteen of the reviewed studies used five or less cases, five used small samples between eight and twenty, and just nine used samples greater than twenty. Insurance companies, banks and public utilities are heavily represented in earlier research, while recent studies have used samples drawn mainly from business firms. Sampling procedures, data collection and analysis in most

Table 1. Summary of Empirical Studies on the Computer Impact

			Impacts			
Study	Type of Sample	N	Clerical Positions	Centralization–Decentralization	Management	Other Impacts
Weber (1959)	Manufacturing	1	reduced	—	—	—
Hardin (1960)	Insurance	1	no impact	—	—	some changes in job contents
U.S.A., Bureau of Labor Statistics, 1960 (Krant, 1962)	Offices	20	reduced few	—	—	—
Hoos (1960)	Companies	19	—	recentralized	reduced middle management positions	—
Shultz & Whisler (1960)	Insurance	5	—	3 recentralized	—	—
Siegman & Karsh (1962)	State civil service bureau	1	—	centralized	—	—
Mann & Williams (1962)	Public utility	1	reduced	centralized	reduced middle management positions	some changes in job content; formalization
Dale (1964, 1973)	Companies	33	25 no impact	13 centralized 6 decentralized; 14 no impact	7 elimination of one level	26 no impact on span of control
Shaul (1964)	Top and middle managers	67 (8 firms)	reduced some	centralized	no impact on top management; number of middle managers increased; more time on planning and directing and less on controling.	wider span of control
Whisler (1965)	Insurance	3	—	centralized	—	no impact on job content; decrease in organization levels
Lee (1965)	Manufacturing company and public utility	2	reduced	no impact	increased number of managers	—
U.K., Ministry of Labour (1965)	Manufacturing and service firms	400	no impact	—	—	—
Wagner (1966)	Public utility	1	—	decentralized	—	—
Delehanty (1967)	Insurance companies	9	reduced	no impact	no impact on middle management	—

Table 1 continued

Brady (1967)	Top managers	100	—	—	no impact	—
Mumford & Banks (1967)	Bank	1	reduced	recentralized	reduced middle management positions	—
Vergin (1967)	Business organizations	11	reduced	recentralized	minor changes	improved decision-making
UN, International Labor Office (1967)	Public sectors of a number of developing countries		reduced demand for clerical personnel	—	—	—
Reif (1968)	Commercial bank, public utility and manufacturing firm	3	reduced	2 centralized	—	—
India, State of Marahastra, 1969 (Baron, 1976)	Various	31	reduced	—	—	—
Whisler (1970)	Insurance Agencies	23	reduced	recentralized	reduced middle management positions	—
Hofer (1970)	Manufacturing companies	2	reduced	no impact	—	—
Klatzky (1970)	State employment agencies	53	—	decentralized	—	—
Argyris (1970)	Bank	1	reduced	recentralized	—	—
India, 1971 (Baron, 1976)	National	140	8 reduced; 16 increased	—	—	—
Stewart (1971)	Various	5	reduced/work volume increased	1 centralized	—	—
Hanold (1973)	Food processing firm	1	—	—	reduced middle management positions	—
Blau, Falbe, McKinley and Tracy (1976)	Manufacturing firms	110	—	decentralized	—	—
Anderson, Hedberg, Mercer, Mumford and Sole (1979)	Banks	5	no impact	—	—	—
Ali (1981)	Public companies	5	reduced	no impact	—	—
Carter (1984)	Newspapers	68	—	varies	—	—

studies do not satisfy the conditions of methodological rigour necessary for generalizing. This study is intended to complement previous research by examining computer impact in a developing country using a sample of public organizations.

Research Hypotheses

Management and the Computer

Managers need information for planning, organizing, controlling and other decision-making functions. It is often assumed — but rarely demonstrated — that if management receives better information in terms of completeness, accuracy and timeliness, then management performance will benefit accordingly. So if computerization can improve the quality of information, then management should improve, though computerization alone is not a sufficient condition. Nil improvement is conceivable if the computer is used for automation purposes only, or if operational and/or human-related problems hinder its utilization. As Sollenberger (1968) reported, managers are not easily persuaded to abandon their own data files and to rely instead on a computer-based information system. Even so, the simplest hypothesis is stated here as a starting point:

Hypothesis 1: After computerization, managers of computerized sub-units will receive better information in terms of completeness, accuracy and timeliness.

Yet, all managers do not use information for the same ends. Their priorities differ according to the work of their sub-units. In sub-units with routine work technologies characterized by low task variability (Hage and Aiken 1969) and low task difficulty (Perrow 1967), priority in using the computer information would be expected to be given to the control function. Routine work units are likely to have mechanistic structures (Argote 1982; Schoonhaven 1981) in which planning and decision-making is highly programmed as a result of detailed policy guidelines and standardized procedures and, thus, requires less information than planning and decision-making in organic structures (Leifer and Delbecq 1978). The primacy of control in mechanistic or bureaucratic organizations is well documented in the literature. This may explain Withington's (1969) conclusion based on a review of previous research that the control function in routine operations is significantly influenced by computerization.

The situation is different in non-routine work sub-units in which management must pay more attention to forecasting, planning and coordination to deal with higher task difficulty and variability. Here management is not primarily concerned with control. Thus, Hypothesis 2 states:

Hypothesis 2: In using computer information, managers of routine work sub-units give priority to the control function while managers of non-routine work sub-units give priority to planning and decision-making.

Clerical Positions and Job Content

Most studies in Table 1 reported some labour-saving as a result of computerization. This usually took the form of a reduction in the number of positions and/or an expansion of operations without increasing employment. Krant (1962) found that in the first stage of computerization, displaced personnel are transferred to expanding departments within the same company. Affected positions are mainly clerical. More positions are expected to become redundant as the degree of computerization and/or proficiency in using the computer increases. The degree of computerization refers here to the extent of computer usage. Hence, it is hypothesized:

Hypothesis 3a: Higher degrees of computerization bring greater reductions in clerical positions.

Hypothesis 3b: Higher degrees of computer proficiency bring greater reductions in clerical positions.

Computerization may also influence job content. Hardin (1960) observed that jobs many include routine and non-routine tasks. The computer replaces the employee in performing the routine component of his job and this may result in the redesign of the job, but not necessarily its elimination. For example, a researcher without the aid of a computer can perform routine operations in data collection and analysis, but his professional knowledge and skills will still be needed after the computer takes over these operations.

Hypothesis 4: Computerization will reduce the routine component in jobs.

Centralization or Decentralization

The most controversial issue in the literature reviewed is whether computer usage induces centralization or decentralization. Early speculative papers (e.g. Leavitt and Whisler 1958; Simon 1960) predicted centralization or recentralization. This was also supported by results obtained by a majority of subsequent researchers: thirteen of the studies in Table 1 found centralization or recentralization in the aftermath of computerization, while only four reported decentraliziation. However, when sample size is counted, it is found that decentralized cases outnumber centralized or recentralized cases. Supporters of the recentralization effect argue that more and better information provided by the computer will allow top management to take decisions back into their own hands. Their opponents who predicted or found decentralization contend that improved information benefits all management levels, and since top management still has neither the time nor the know-how to make decisions presently made at lower levels, further decentralization is the most likely result. These conflicting views led Hunt and Newell (1971) to conclude that the computer does not have a deterministic effect on organization structure, and Gilman (1966) had earlier observed that the computer can support either greater centralization or greater decentralization.

Other conceptions of the computer impact on centralization–decentralization using moderators have been suggested by Klatzky (1970), Robey (1977) and Carter (1984). Klatzky (1970) found that increasing computer utilization as indicated by the number of computer and input–output units is associated with decentralization. Carter (1984) argued that the effects of computerization appear when familiarity with the computer technology and proficiency in using it increase. She observed that studies dated before 1970, when computer proficiency was low, found more cases of centralization or recentralization but since then, as proficiency increased, more cases of decentralization were reported. This implies that a time-lag exists between the introduction of the computer technology and its full utilization, and ultimately the manifestation of its impact.

Robey (1977) introduced another moderator, namely the organizational task environment. He concluded after reviewing relevant literature that organizations operating within relatively stable environments tend to recentralize, while those coping with high degrees of environmental change and turbulence strengthen their decentralized structures.

Following the more convincing conclusion of Hunt and Newell (1971) that the work technology of a computerized sub-unit moderates the computer impact on centralization–decentralization, decision-making in sub-units with stable routine work is likely to be centralized either at the highest authority level within the sub-unit or at a higher superordinate level. Indeed, earlier studies which found computerization to be associated with centralization were conducted on organizations which were, as Delehanty (1967) described them, already highly centralized. Support for this view is provided also by Sanders (1968) who argued that if the computer is used for routine applications only, it will have no effect on centralization–decentralization but this will not be the case if sophisticated applications are introduced. Obviously, the possibility of using the computer for other than routine applications does not arise in routine work sub-units and, hence, centralization with either remain unchanged or will be increased.

It follows that higher computerization leads to further routinization in routine sub-units and is likely to decrease the need for discretion at lower levels. The result obtained by Klatzky (1970) linking decentralization with higher computerization is expected to occur in non-routine sub-units only. In these sub-units, the computer will take over programmed tasks and routine decisions, and allow more time and effort to be devoted to higher-order tasks and decisions. Given the organic structure of these sub-units, computerization is expected to result in further decentralization or strengthening of the already decentralized structure. The following hypotheses can now be suggested:

Hypothesis 5: Computerization in routine work sub-units is associated with no change or an upward shift in the locus of decision-making.

Hypothesis 6: Computerization in non-routine work sub-units is associated with no change or a downward shift in the locus of decision-making.

Method

Sample

For the study reported here, the sample was drawn from public sector organizations in the Kingdom of Saudi Arabia — an oil-rich Middle Eastern developing country. An updated survey prepared by the Computer Department of the Institute of Public Administration in this country reported 60 public agencies having medium to large-capacity computer facilities in 1986. Fifteen of these were initially excluded either because of the nature of their functions (military or internal security) or because their computer systems were not yet operational. Of the remaining forty five agencies, sixteen agreed to cooperate, being almost 27 percent of computer-utilizing agencies. They include four national ministries, four public corporations, six public service agencies and two universities. Fifteen agencies have centralized in-house mainframes or minicomputers and one is using time-sharing services.

A total of 42 sub-units from the sixteen public agencies were included representing staff and support sub-units such as planning, budgeting, accounting, payroll and personnel as well as functional-line sub-units. The highest number of sub-units (17) were from the four public corporations, ten sub-units from public service agencies, eight sub-units from the universities and seven sub-units from the ministries. As a condition for inclusion in the sample, a sub-unit must have been using one or more computer applications for at least one year before 1986 when this research was conducted. A sub-unit is usually made up of two organizational levels: the sub-unit's manager or supervisor and his immediate subordinates. The size of sub-units ranged from 3 to 168 employees with an average size of approximately sixteen. Computer applications used in each sub-unit served its needs and did not cut across sub-unit's lines.

A mailed questionnaire was used to collect data from each of the 42 sub-unit managers and additional data were obtained from organization charts, job descriptions, official documents and reports and, to a lesser extent, through interviews. Useful responses were provided by all 42 sub-units but, in some cases, a few questionnaire items were unanswered.

The degree of computerization was measured by the number of computer applications or programmes in use. This was considered a better indicator of the level of computer usage at the sub-unit level than the number of computer and input–output units proposed by Klatzky (1970). The number of computer applications presently in use in the 42 sub-units is 90 — a considerable increase on the 13 applications available in 1982. The number of applications per sub-unit varied between 1 and 14 with an average of approximately 2.

Following Carter's (1984) model, proficiency in computer usage was measured by the number of years since the introduction of computerization into the sub-unit. Computerization was introduced in one sub-unit as early as 1971 but the average time of computer usage in the sample is 3.61 years. This indicates that the transfer of computer technology into the public sector of Saudi Arabia has begun only recently.

Sub-units were dichotomously classified by the author as having routine or non-routine technology on the basis of a content analysis of the tasks of the sub-unit in terms of difficulty and variability (Hage and Aiken 1967; Perrow 1967; Van de Ven and Delbecq 1974). The task difficulty dimension reflects the extent of available regulations and procedures determining task performance. The variability dimension indicates the degree of repetitiveness or stability of the task. Accordingly, the work technology of 22 sub-units was classified as routine and included: 10 accounting, 5 personnel, 3 filing, 2 payroll and 2 mail sub-units, while the other 20 sub-units had non-routine work technology: 7 functional, 7 planning and budgeting, and 6 information and research. Routine work sub-units perform well-defined tasks in accordance with detailed rules and regulations set by central agencies such as the Civil Service Commission (personnel and payroll sub-units) and the Ministry of Finance and General Audit Bureau (accounting sub-units). Exceptional cases encountered by routine work sub-units are few and must be referred to the specialized central agency for specific rulings. Also, average job requirements, position grades on the civil service scale and educational and skill levels of a routine sub-unit's personnel are lower than in non-routine sub-units. Data for this measurement were obtained from official records, documents and reports.

Two identical sets of items were used to assess the accuracy, completeness and timeliness of information received by sub-unit managers before and after computerization, each scored on a five point rating (see Appendix). Respondents were also asked to evaluate on a five point scale the usefulness of computer information in performing the following six functions: planning and programming, control, making major decisions, making operational decisions, coordination and processing a sub-unit's operations. The manager's subjective evaluation was used in the absence of any performance measurement in the public agencies.

The computer impact on the number of positions was measured by comparing the number and titles of positions in each sub-unit before computer usage and at the time of data collection. To measure the impact on job content, respondents were asked to indicate whether duties and responsibilities of positions had been changed after computerization and to list the positions involved and the changes made.

Shifts in the locus of decision-making were measured by a three-item scale asking the sub-unit's manager to indicate whether his delegated authority, his participation in decision-making with his superior, and his subordinates' participation in decision-making had increased, decreased or remained unchanged after computer usage.

Results

The first hypothesis was supported; a majority of managers (87.5 percent, $n = 40$) reported some improvement in the timeliness, accuracy and completeness of information after computerization and none indicated a decline in the quality of information. Information timeliness was especially enhanced. Sub-units from public corporations and service agencies reported the highest improvement in information followed by sub-units from universities and ministries, respectively.

The result of a Wilcoxon matched-pairs signed ranks test on information quality scores before and after computerization confirmed that the changes were significant ($z = 4.83$ $p<0.1$).

Results show that the processing of a sub-unit's operations benefits most from the computer information both in routine and non-routine sub-units. However, there are differences in the utilization of this information in performing managerial functions between routine and non-routine sub-units, as predicted in Hypothesis 2. As Table 2 shows, control and coordination functions received higher priorities in the utilization of computer information in routine sub-units, whereas making major decisions and planning were the priorities in non-routine sub-units. The difference, however, was not statistically significant.

Computerization had little effect upon jobs. In Hypothesis 3, a reduction of clerical positions was predicted but results did not support this. Only five cases (15.6 percent, $n = 32$) reported some reduction in clerical positions after usage, and the total number of affected positions was small. On the other hand, an equal number of sub-units reported small increases in employment. Much of the reduction or increase in the number of positions was reported by sub-units in public corporations and service agencies. Sub-units with higher degrees of computerization or higher computer proficiency did not show higher degrees of staff reduction and thus the hypothesized moderating effects of the level of computerization and computer proficiency were not supported.

Moreover, computerization appears to have a negligible effect on job content. Contrary to the prediction in Hypothesis 4, less than 1 percent of all positions in the sampled sub-units were redesigned. This involved replacing routine tasks in some clerical jobs with computer-related tasks.

As for decision-making, an upward shift (i.e. centralization or recentralization) was reported by only two cases in the whole sample, while a downward shift was found in five of the routine work sub-units. These results contradict Hypothesis 5 and indicate that computerization also has little effect on the locus of decision-making in routine work sub-units.

However, in non-routine sub-units, there was a noticeable effect. A downward shift in the locus of decision-making was found, as predicted in Hypothesis 6, but the results did not support the hypothesized moderating influence of the level of computerization on the locus of decision-making ($b = 6$, $p =$ n.s., Fisher exact test).

Table 2. Cross-tabulation of Management Use of Computer Information by Work Technology

Work Technology	*n*	Management Use of Computer Information by Rank: Processing Sub-unit's Operations	Control	Coordination	Planning	Making Major Decisions	Making Operational Decisions
Routine	20	1	2	3	4	5	6
Non-routine	17	1	5.5	5.5	3	2	4

Table 3
Cross-tabulation of Work Technology by Shift in Locus of Decision-making

	Work Technology	
Shift in Locus of Decision-making	Non-routine Units	Routine Units
Downward	14	5
No change	4	13

$X^2 = 9.03, p < .001$

In view of these results, it was decided to explore the effect of the level of computerization on the locus of decision-making irrespective of work technology. As results in Table 4 show, a higher degree of computerization is associated with a downward shift in the locus of decision-making. In the main, this shift resulted from increases in the degree of participation in decision-making of the sub-unit's manager and his subordinates and not from an increase in his delegated authority. Finally, no relationship was found between type of sub-unit's parent organization (ministry, university, service agency and public corporation) and shifts in the locus of decision-making.

Table 4
Cross-tabulation of Degree of Computerization by Shift in Locus of Decision-making

	Degree of Computerization	
Shift in Locus of Decision-making	High (>2)	Low (≤2)
Downward	13	4
No change or Upward	3	14

$X^2 = 9.03, p < .001.$

Discussion and Conclusions

Results show that computer usage in Saudi public organizations has improved the quality of information received by managers of computerized sub-units. Improvement — though it may be, in fact, marginal — was perceived to be significant in comparison with information available before computerization. Nevertheless, it has to be recognized that this effect may not be totally attributed to the computer, since the change to computerization usually involves a redesign of work procedures and communication channels. It is conceivable that, even without computerization, some similar changes might have been made.

It is essential to consider also the possible influence of culture and other situational factors. Although Saudi public managers occasionally express doubts about the feasibility of computerization, none would disagree with its general usefulness. This reflects, to some extent, their eagerness to impress others with their progressive attitudes and their readiness to adopt new innovations. For example, managers in one public agency recently expressed their disappointment with a decision to remove computer terminals from their offices. It was officially announced that the decision was taken to reduce costs, though most of them did not benefit from computer applications and could not even operate the terminals.

Computers in sampled sub-units are being used mainly for processing routine operations. However, information is generated as a by-product and its usage by management appears to be related to user's needs which vary with the work technology of the sub-unit.

Surprisingly, the results show that computerization did not lead to a reduction in clerical–routine positions nor to a displacement of routine components in jobs. In most cases, managers indicated that pre-computerization manpower levels were below actual needs and, hence, displaced employees may have been used to satisfy these needs. The influence of culture may also be evident again here. For the Saudi public manager, the number of his subordinates is an indicator of his power and influence within the bureaucracy, which has significant implications for his social status. Officials of the Ministry of Finance who conduct an annual review of manpower needs consider estimates presented by public agencies exaggerated and often reduce them by as much as 50 percent.

Further, clerical jobs affected by computerization are often occupied by Saudi nationals, and dismissing them is unacceptable in view of a current 'Saudization' programme aimed at replacing expatriate employees who constituted 30.6 percent of total public service employment in 1986. Rather than dispensing with them, these employees are retained to process manually, work which has also been entered in the computer. The justification offered for this duplication of efforts is that the risk involved in becoming dependent on the new technology is unacceptable, since possible disruptions can result from long periods of breakdown in view of inadequate maintenance services.

The view that increased computerization is likely to result in decentralization was supported. Contrary to predictions made in this research, this relationship was not moderated by work technology, This result, however, confirms the view frequently mentioned in the literature that more and better information made available by the computer to subordinates encourages decentralization. At the same time, it is conceivable that managers who seek to exploit the computer potential by introducing more computer applications are progressive-minded managers who would be more willing to decentralize in any case.

The fact that available computer resources in sampled organizations are under-utilized emphasizes the problems encountered by a developing country in trying to transfer new technologies to itself. High-pressure marketing, inadequate feasibility studies, and the computer appeal as a symbol of modernization are among the reasons behind this particular developing country having more computer capacity than it needed. The major obstacles to computer use are a shortage of qualified computer personnel and low user involvement in application development, as indicated by the number of applications initiated by top management and computer staff (51 percent). House-keeping functions are the most frequently automated and even in non-routine sub-units, where opportunities for sophisticated computer applications are available, few of the applications in use can be considered advanced. In short, the computer systems in use exhibit features of Dickson's (1968) clerical system which is the lowest-level system on his five-level hierarchy of information processing systems. A clerical system generates summary information of little usefulness for management planning and control functions. In the absence of any reduction in clerical expenses, the high cost involved in installing and operating such a system is not justified.

These limitations on computer use, together with the cultural factors mentioned earlier, may explain why research results did not show a significant computer impact on the Saudi public bureaucracy. Future research on this topic must take these factors into consideration as well as other moderators included in this and previous studies.

Appendix

A. Scale measuring changes in quality of information:

Responses to each of the six items were measured on a 5-point rating scale: always, often, occasionally, seldom, never. (*R*) indicates a reverse scoring.

1. 'Indicate your evaluation of information you received and used in decision-making and in managing your sub-unit's operations before computerization in terms of:

1/1 accuracy
1/2 completeness
1/3 timeliness (R).'

2. 'How do you evaluate information you receive now after using the computer in terms of:

2/1 accuracy
2/2 completeness
2/3 timeliness (R).'

B. Scale measuring usefulness of computer information:

Responses were measured on a 5-point scale: very high, high, fair, low, nil: 'To what extent do you benefit from computer information in performing the following tasks:

1. planning and programming,
2. control and follow-up,
3. coordination,
4. making major decisions,
5. making operational decisions,
6. processing a sub-unit's operations.'

Note

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